LIFEPAC®

SCIENCE

STUDENT BOOK

11th Grade | Unit 10

Alpha Omega
PUBLICATIONS

SCIENCE 1110
ATOMS TO HYDROCARBONS

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

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Alpha Omega PUBLICATIONS

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Atoms to Hydrocarbons

Introduction

This LIFEPAC® is a review of the whole Science 1100 series. You may find it necessary to review in more depth those specific objectives that you do not fully comprehend. You will need the Periodic Table that accompanied Science 1101 for reference in this review.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. When you have finished this LIFEPAC, you should be able to:

1. Describe and use the metric system.
2. Hypothesize and observe.
3. Use scientific notation.
4. Describe elements, compounds, and mixtures.
5. Explain and use the gas laws.
6. Explain the Kinetic Molecular Theory.
7. Apply the mole concept.
8. Describe atomic structure and periodicity.
9. Predict chemical formulas, describe chemical bonding, and explain molecular architecture.
10. Explain chemical reactions, reaction rates, and equilibriums.
11. Describe equilibrium systems.
12. Explain the chemistry of hydrocarbons.
13. Identify and describe the organic functional groups.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

1. CHARACTERISTICS OF ATOMS AND MOLECULES

Chemistry is a very old science. Every substance we see, smell, or touch is a chemical. The application of chemistry to change man's environment was known very soon after he was created. Genesis 4:22 indicates that brass and iron were already used for sculpturing and building materials. Copper and zinc, of which brass is a mixture, do not occur in nature as pure substances, nor does iron. It follows then that man must have been able to refine natural ores, to smelt them, and to purify the resulting mixtures as early as 6,000 years ago.

Our bodies, all plant and animal life, changes in our physical world, the fuels we burn, the energy from the sun, and the plastics and containers we use all involve chemistry. To be good stewards of the world God created and put in our charge, we must have a good working knowledge of chemistry. Our wise use of the resources of this planet is not done automatically. When man is left to his own, he self-destructs through pollution, resource gluttony, and greed which interferes with the natural laws and balances the Creator established. We are commanded to subdue and use the resources for our benefit. However, our sinful nature causes us to misuse it instead of managing it wisely.

Our study of chemistry is designed to help us understand the material world around us, develop an appreciation of the beauty and marvel of his Creation, and wisely use and develop the resources of this planet and universe.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Describe and use the metric system.
2. Hypothesize and observe.
3. Use scientific notation.
4. Describe elements, compounds, and mixtures.
5. Explain and use the gas laws.
6. Explain the Kinetic Molecular Theory.
7. Apply the mole concept.
8. Describe atomic structure and periodicity.
9. Predict chemical formulas, describe chemical bonding, and explain molecular architecture.

| Instruments of length

MEASUREMENT AND OBSERVATION

Measurement with the use of instruments and observation of details are critical to the scientific method and accurate conclusions. In this section you will review the metric units of measurement, the process of observation and hypothesizing, and the use of scientific notation. For further help you may wish to review Science LIFEPAC 1101.

Metric units. Science and scientists have used the metric system of measurement for almost two hundred years. This system is much like the American monetary system, which is based on multiples of ten. The metric system is used in nearly all countries in the world for the standard units of measurement. America has been using this system in the scientific world for many years. As early as 1790, colonial leaders proposed that the metric system be adopted as the official American system of measurement. The metric system was legalized in America in 1866 by an act of Congress.

In chemistry, the units used most frequently are mass, volume, and length. The metric system is of French origin. About 1790 it came into prominent use and was soon adopted as the official French system of measurement. From that time on, it was adopted by nearly all countries throughout the world. The modern metric system is known as the *International System of Units*. The name *International System of Units* with the international abbreviation *SI* was given to the system by the General Conference on Weights and Measures in 1960. The metric system has had a very interesting history in America.

Units			Prefix			Symbol
kilometer	=	1000 meters	kilo	=	1000	km
meter	=	1 meter				m
centimeter	=	1/100 meter	centi	=	1/100	cm
millimeter	=	1/1000 meter	milli	=	1/1000	mm

In chemistry we will use *defined* units of metric measurement for length, volume, and mass; the *meter*, the *liter*, and the *kilogram*, respectively.

Length is the measure of the distance from one point to another. It can be measured in large units like light years or small units like angstroms. The standard unit of length in the metric system is the *meter*. All of our measurements of length and volume derive from this standard.

The meter is a standard length about the length of your arm. The definition of a meter has changed somewhat with time. The first definition was one ten-millionth of the distance from the North Pole to the equator as measured along a meridian. Obviously, this distance was difficult to measure accurately. Thus, for many years the meter was defined as the distance between two etched lines on a platinum iridium bar kept in Sevres, France. Although this definition was more useful, it was difficult to produce replicas for use in other parts of the world.

From 1960 to 1983, scientists agreed that one meter equaled 1,650,763.73 times the wave length of the orange-red spectral line in an isotope of Krypton-86. In 1983, the meter was defined as the distance light travels in a vacuum in 1/299,792,458 seconds. In our studies we will be satisfied with less precision and will use the metric rulers available as reproductions of the etched bar.

The meter (m) is the primary unit of length. Conventional multiples and subdivisions of the meter are the kilometer, centimeter, and millimeter. The kilometer equals 1,000 meters, the centimeter equals 0.01 meter, and the millimeter equals 0.001 meter.

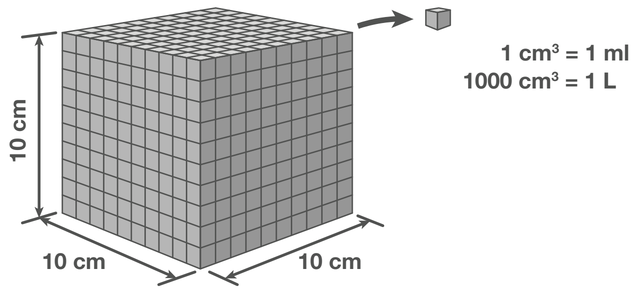
Sometimes we encounter dimensions that are inconvenient to use because of the units in which they are expressed. For example, 0.0003 km is not so convenient as its equivalents, 0.3 m or 30 cm. Similarly, 402,000 mm is more conveniently written 402 m or 0.402 km. Therefore, we must convert back and forth among equivalent units.

Complete the following chart based on the prefix definitions.

1.1

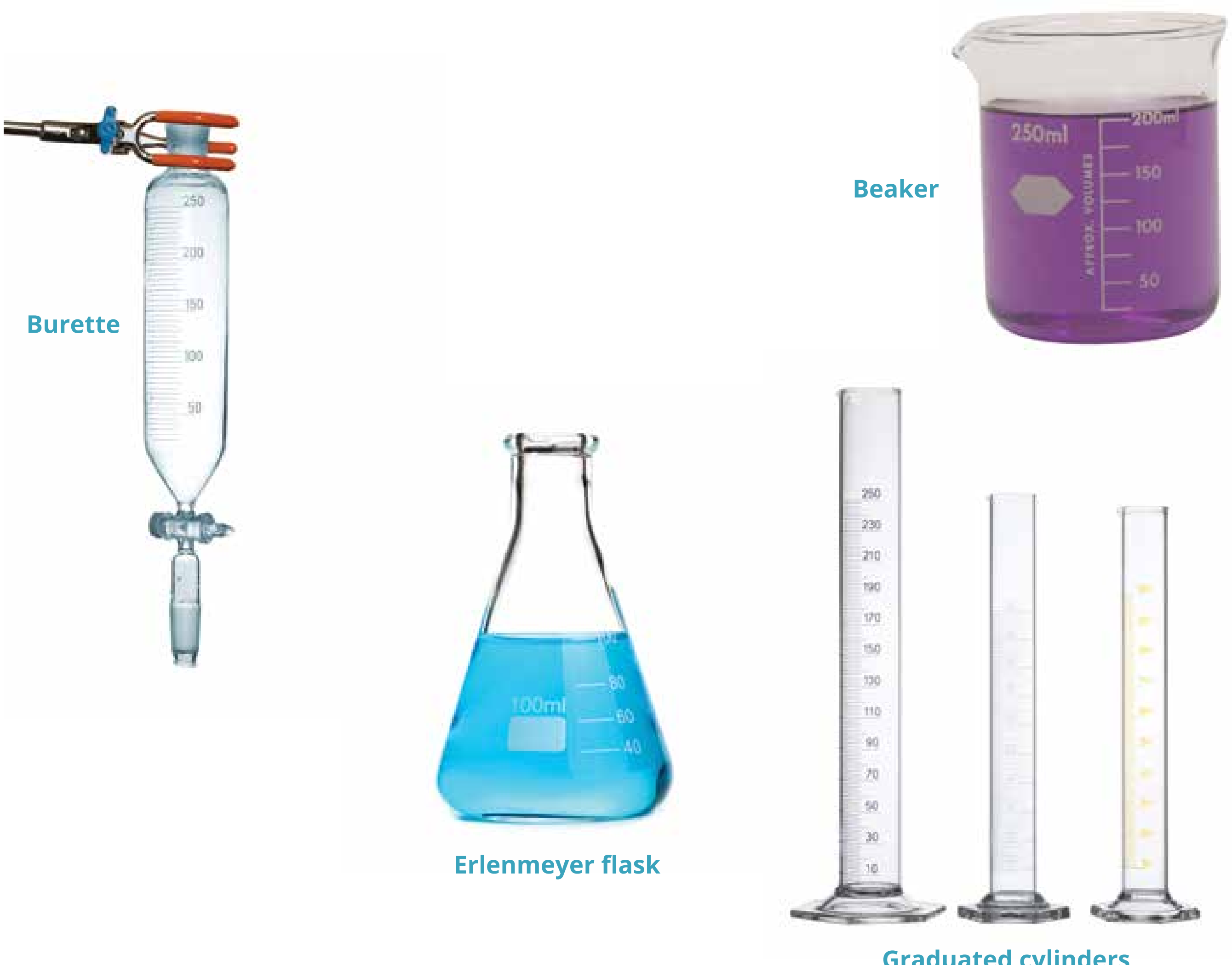
	kilometer km	meter m	centimeter cm	millimeter mm
	0.001	**1**	**100**	**1000**
a.		100		
b.			120	
c.			0.1	
d.		63		
e.				126.3
f.		31.5		
g.	0.536			
h.			1.92	
i.		6.84		
j.				9.30
k.	61.39			
l.		0.1516		
m.			0.0031	
n.				123,400
o.	0.00000036			
p.				3660

Volume might be defined as length in three dimensions: i.e., height × width × thickness. When you multiply these three dimensions, a cubic dimension results. All liquids, solids, and gases occupy a volume because they all take up space.



The primary unit of metric volume is the liter (L). It is *defined* as one-thousandth cubic meter. This volume is the same as a cube 10 cm on a side or 1,000 cm^3 (10 cm × 10 cm × 10 cm).

A more common volume unit used in our chemistry laboratory is the milliliter (ml). This unit is one-thousandth liter and is the same as one cubic centimeter (1 cm^3). This unit is the one we have used most of this year.



| Instruments of volume

Complete the following chart based on volume comparisons.

1.2

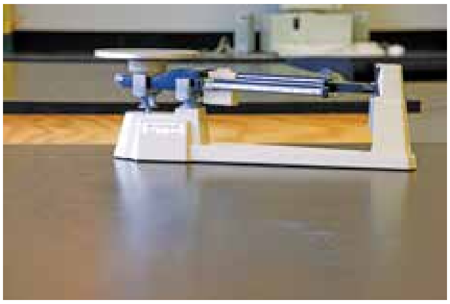
	cm^3	ml	L
	13.5	13.5	0.0135
a.			2.10
b.			0.00105
c.		941	
d.			0.1005
e.		10,300	

	cm^3	ml	L
f.		0.025	
g.			22.4
h.		12.86	
I.			0.321
j.		22.4	
k.			0.025

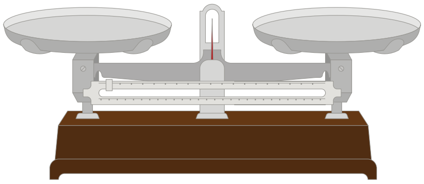
Mass is a measure of the "stuff " in an object. The amount of matter of which you are made is your mass. The amount of matter in an unopened box of salt is the same *wherever it is in the universe*. All matter has mass.

The primary mass unit for the metric system is the kilogram (kg). This standard is a platinum iridium cylinder that is kept in the *Bureau International des Poids et Mesures* (International Office of Weights and Measures) in Sevres, France. All kilogram mass pieces are made as duplicates of that standard.

A more common mass unit used in our chemistry laboratory is the gram (g). The gram is one-thousandth of a kilogram. For our purposes, one gram is the mass of 1 cm^3 (1 ml) of water at 4° Celsius. Sometimes in advanced work in chemistry the smaller mass unit, the milligram (mg), is used. One gram is equal to 1,000 mg. Also, common to some chemistry laboratories are centigram (cg) balances. They can measure to the nearest cg or one hundredth g.



Triple-beam centigram balance



Platform balance

Electronic scale

| Instruments measuring mass

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